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The Structured Accession Planning System for Officers (STRAP-O) is a set of models for determining the feasibility of proposed manpower plans or programs and indicating directions likely to achieve those plans. STRAP-O integrates accession and promotion planning functions with manpower requirements both technically and organizationally. This report describes the system's components, its architecture, the flow of information, and outputs.

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THE STRUCTURED ~~ASSESSION~~ ACCESSION PLANNING SYSTEM FOR OFFICERS (STRAP-O): A SYSTEM FOR ASSESSING THE FEASIBILITY OF NAVY OFFICER MANPOWER PLANS

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THE STRUCTURED ACCESSION PLANNING SYSTEM FOR OFFICERS (STRAP-O): A SYSTEM FOR ASSESSING THE FEASIBILITY OF NAVY OFFICER MANPOWER PLANS

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FOREWORD

This research and development was conducted in response to Navy Decision Coordinating Paper Z1187-PN (Computer-based Manpower Planning and Programming) under subproject PN.02 (Officer Personnel Management Models) and the sponsorship of the Deputy Chief of Naval Operations (OP-01). The objective of the subproject is to develop a set of user-oriented, computer-based models and techniques to assist in the development of a Navy officer force that meets the Navy's manpower requirements.

This report describes the design, structure, and capabilities of the Structured Accession Planning System for Officers (STRAP-O), which is currently operational in OP-01 as a tool for assessing the feasibility of future officer manpower plans.

JAMES F. KELLY, JR.
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SUMMARY

Problem and Background

To properly address the feasibility of future officer manpower needs requires the simultaneous consideration of manpower requirements, the existing and projected personnel inventory, and the projected supply of new officers. Conceptually, all of these management functions are interrelated, but they are organizationally distinct and lack the coherent linkages necessary to respond adequately and rapidly to planning and programming questions. To come closer to the way the officer manpower system really works and to improve response time, officer manpower management must function dynamically using a common set of models and policies. The technical and organizational linkage of manpower planning functions is found in the Structured Accession Planning System for Officers (STRAP-O). This system determines the feasibility of proposed manpower plans or programs and indicates directions likely to achieve those plans.

Objective

This report describes the components or modules of STRAP-O, the system architecture and flow of information between modules, and the resulting outputs. The operation and use of STRAP-O is illustrated by several scenarios.

System Components

Since the purpose of STRAP-O is to assess the feasibility of attaining and maintaining alternative manpower levels, its central focus is on the personnel inventory and accessions necessary to achieve those manpower goals. This aspect of the STRAP-O system consists of the explicit linkage of two models--an accession planning model (AIDS) and a force projection model (OPRO). This linkage permits AIDS to use personnel flow rates that do not simply reflect historical promotion policies and loss behavior, but the promotion policies under consideration and losses expected to occur in the planning horizon. In turn, an optimal accession plan is passed from AIDS to OPRO. This process of determining accessions and flow rates continues until the system "converges"; that is, the two models are flowing personnel in the same ways and, hence, operating as a system.

System Operation

1. The STRAP-O system provides manpower managers in OP-01 with the ability to determine if a desired force level is feasible in terms of expected and/or desired retention, the number of accessions required to support the new force levels, and the available supply of officer candidates to support the accessions, the promotion and lateral transfer plans and policies required, the demands on the training establishment, the manpower overhead needed to sustain the force, and the budgetary cost associated with the new force.

2. STRAP-O consists of several interrelated programs or modules that represent key officer manpower planning functions, including accession planning, strength planning, and loss forecasting.

3. The force projection model, OPRO, is designed to forecast personnel flow behavior of officers as they are gained or lost to the system, promoted, or "aged." By imposing management intentions concerning accessions, expected losses, and a promotion policy, it forecasts and summarizes the personnel flows in terms of continuation rates. The rates then become inputs to the AIDS accession planning model.

4. AIDS is a goal programming model that determines the optimal number of officers to access each year from each commissioning source to achieve future force structure goals specified by total force, as well as by individual community.

5. A third major module, the officer retention forecasting model (ORFM), permits the testing of compensation and other retention-oriented policies as a means of modifying officer personnel inventory relative to the future force goals.

6. The STRAP-O system is designed to assist in personnel budget planning over a 7-year period. This planning horizon is divided into two subperiods. The first is a 2-year strength planning period that establishes a predicted inventory for the beginning of the second subperiod, the 5 year Defense Plan.

Applications

An initial version of STRAP-O, explicitly modelling only the unrestricted line (URL) planning function, was installed in OP-01 in September 1981. A total force version, including restricted line (RL) and staff corps communities, was implemented in March 1982. Future versions will include a "user-friendly" control module and systematic data processing procedures.

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produced by these programs enter a variety of specialty areas (e.g., aviation, submarine warfare). The U.S. Naval Academy (USNA) and the Naval Reserve Officer Training Corps (NROTC) programs supply officers for a wide range of specialty areas, while other sources, such as the Naval Flight Officer Candidate (NFOC) program, supply a single specialty area. It has been observed that career continuation behavior differs according to an officer's commissioning source and specialty (Goudreau, 1977). Thus, the choices of which commissioning programs to use and how to distribute officers from these programs to specialties have a major influence on the Navy's ability to meet future requirements for experienced officers. Commissioning programs also differ in other ways important for planning purposes--cost, capacity, and length of training.

Prior to AIDS, accession plans were developed by each "community" (e.g., pilots) independently. Occasionally, these plans identified a "choke point" in the community's career path, such as the department head tour, where requirements persistently exceeded projected inventories for a critical assignment. Accession plans were then developed to overcome those "choke points." More frequently, the accessions were planned to fill the gap between total allowable community strength and onboard inventory. In either case, an overall accession planner brought the individual community plans together in what proved to be a protracted negotiation process to produce an all-Navy plan.

In contrast, AIDS simultaneously considers both community and all-Navy needs. The model identifies all feasible commissioning mixes and projects them forward (for 10 years), using continuation rates for each source and community combination. These inventories are then compared to requirements. The optimal commissioning mix is the one that minimizes the sum of penalties. Penalties are specified by the user to reflect priorities. For example, it may be more important to access to meet all submarine requirements before meeting aviation's needs.

The fundamental feature of STRAP-O is the simultaneous consideration of accession and promotion plans designed to achieve a particular set of manpower goals. This requires linking the accession planning model, AIDS, to the force projection model, OPRO, so that the flow rates used in AIDS do not simply reflect historical promotion policy and loss behavior but, instead, the promotion policies under consideration and losses expected to occur in the planning horizon. In turn, an optimal accession plan is passed from AIDS to OPRO. This process of determining accessions and flow rates continues until the system "converges"; that is, the two models are flowing personnel in the same ways and, hence, operating as a system.

The force projection model, OPRO, forecasts personnel flow behavior of officers as they are gained or lost to the system, promoted, or "aged." OPRO is a "fractional flow model with foresight" (Grinold and Marshall, 1977). That is, it anticipates vacancies and accesses or promotes enough replacements to fill the vacated positions. By imposing management intentions concerning accessions, expected losses, and a promotion policy, it forecasts and summarizes the personnel flows in terms of continuation rates. These rates then become inputs to AIDS.

Loss rates, as input to OPRO, are forecast by the officer retention forecasting module (ORFM). ORFM estimates the changes in loss behavior that are expected to occur in specific communities as a result of changes in compensation policies (e.g., new or increased continuation bonuses). The model captures an officer's expected life-stream earnings from the decision to remain in the military and the decision to return to civilian life. By mathematically relating the two earnings streams to the current and historical loss rates, estimates of future loss rates can be made, given the earnings streams implied by alternative compensation policies. Within STRAP-O, ORFM permits the testing of

compensation policies as means of modifying officer personnel inventories relative to requirements. Eventually, ORFM will include variables that account for the effects of changes in exogenous events (e.g., external employment conditions) and in the composition of the force (e.g., demographic mix).

The primary input to the STRAP-O system is a set of manpower requirements that describes the personnel implications of alternative Navy missions. These requirements are represented by authorized billets, "true" requirements from the Navy Manpower System (NAMPS), an objective force,[2] variations of these requirements, or other goals specified by the user.

The requirements are composed of two groups: (1) operational and support billets, known as "structured spaces" (jobs directly associated with accomplishing service missions) and (2) manpower overhead billets, or "unstructured spaces," such as students, transients, and patients. These billets are not involved in accomplishing a mission but are necessary to keep structured spaces filled. Officer structured spaces are further defined as a combination of community warfare billets (e.g., pilots) and managerial billets (1050s/1000s) that can be filled by an officer from most communities.

The aggregation of these manpower requirements forms the goals that AIDS and OPRO seek to achieve. To ensure that STRAP-O is highly responsive, the process of taking a simply-stated set of requirements from the user (e.g., pilot requirements by grade) and converting it to a comprehensive set of goals compatible with AIDS and OPRO is completely automated in the OGOALS module.

As a "front-end" to AIDS, OGOALS performs a three-step process: (1) the warfare-specific structured spaces from a variety of dimensions (typically, grade/community) are translated into the community and experience level (defined by contiguous length of service cells) dimension employed by AIDS, (2) the remainder of the structured spaces, the managerial billets, are allocated to specific communities and then translated as above, and (3) the manpower overhead, as a function of the size and configuration of the structured spaces, is applied. If the user supplied only total officer strength requirements, OGOALS, working backwards, estimates the portion of that force needed for overhead spaces and then divides the remaining structured spaces into community specific goals. For OPRO, the OGOALS module produces total strength and specific grade goals from the same requirements set used for AIDS. This ensures that both modules are driving toward consistent targets.

The outputs of the STRAP-O system are of two types--those that are printed and those stored on disk or tape. Printed output contains information that can easily be controlled by the user. In addition to input data describing the planning scenario, the prescribed accession plan, a personnel force structure (personnel arrayed by pay grade and length of service) for each community for each year and summary promotion policy data are displayed.

The stored output provides input for additional reports and supplies a peripheral program, the MPN (for Military Personnel, Navy--the military manpower budget account) costing module. Data for all STRAP-O reports is maintained on an "audit trail," which permits a formal accounting of all STRAP-O personnel flows.

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[2]Unlike "true" requirements or authorizations, an objective force is not a function of workload. Instead, it is driven by personnel considerations. An objective force specifies the manpower configuration needed to sustain desired personnel policies such as consistent promotion flow points and opportunities.

An important step in the Navy's programming process is the "roughly right" estimation of the size of the officer manpower budget implied by alternative personnel force levels. To properly cost the manpower configurations generated by STRAP-O, the budget consequences of promotion behavior and longevity distributions of the personnel strength must be determined. To accomplish this, the MPN module produces an estimate of total basic military compensation (BMC) costs, an estimate of the cost of all other non-BMC budget items, and a total officer MPN cost, given an officer force structure produced by OPRO.

Finally, the development and use of the STRAP-O system of models implies the need for large data bases and extensive data processing activities. Each model requires data in certain formats and employs parameters that need to be validated and reestimated periodically. In terms of total cost, the models themselves represent the tip of the iceberg—the cost below the waterline is generated by the data processing requirements. Without data support systems, the STRAP-O system would soon lose its design capabilities. A system of data processing procedures, designed to create and maintain personnel inventory and flow arrays and produce a variety of outputs, is currently under construction. These outputs will, in turn, become inputs to the STRAP-O models.

SYSTEM OPERATION

The STRAP-O system is designed to assist in personnel budget planning over a 7-year period. The first is a 2-year strength planning period that establishes a predicted inventory for the beginning of the second subperiod, the 5-year defense plan (FYDP) or programming period.[3]

The STRAP-O program operates on a begin inventory for the current fiscal year and projects it (via OPRO) 2 years into the future using a combination of historical and user-supplied parameters to estimate gains and losses. The purpose of this simulation is to establish the planned beginning inventory for the FYDP, which is then used as input to the other STRAP-O models. The processing of the inventory through the FYDP involves interaction between OPRO and the other modules of STRAP-O, particularly AIDS. Again, historically-derived and user-supplied parameters are used to control each scenario.

An example of a programming exercise will help illustrate how the STRAP-O system functions. Suppose two new aircraft carriers are being considered for commissioning 5 to 7 years from today. They will bring with them requirements for additional officers with specific skills and experience and still more officers in the pipeline to support those in the structured spaces. The programming issue is, given current inventory, expected losses, desired promotion plans, and planned accessions over the next 5-7 years, whether the increased demand for officers can be accommodated. If not, how can the personnel inventory be affected to come closer to meeting the goals?

STRAP-O begins by estimating loss rates using ORFM, and then applying them to current inventories in OPRO. Some accession levels are specified (which, initially, may come from a source other than AIDS), along with a desired promotion plan and pay grade strength targets (from OGOALS). OPRO then generates inventories and continuation

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[3]Programming scenarios are not carried out for the first subperiod (current year + 1), because the force for those years is generally considered "locked in" by previous programming and budgeting actions.

rates describing officer personnel flow behavior under these policy specifications. The rates are passed to AIDS and an optimal accession plan is determined--one that comes as close as possible to meeting the future manpower requirements. The derived accession plan is returned to OPRO and the force is once again projected. New and different continuation rates are again passed to AIDS. This process of determining accessions and flow rates continues until the system "converges." Mechanically, it means that AIDS is producing the same accession plan and the same projected personnel force structure as OPRO in two successive iterations. Practically, it indicates that AIDS and OPRO are flowing personnel in ways that reflect identical loss and promotion behavior. In other words, AIDS and OPRO are operating as a system.

APPLICATIONS

In addressing the feasibility of future force levels, STRAP-O is typically employed in one of two ways--as a descriptive or as a prescriptive planning tool. Given a set of desired (or expected) personnel policy parameters, loss and lateral flow rates, and current inventories, STRAP-O determines the "distance" of projected strength from a set of goals. The goals may be infeasible because they require unacceptably rapid (or slow) promotion and suggest more accessions than either the commissioning sources or training plant can produce, or the desired force may simply be too expensive. STRAP-O can then be used in "diagnosing" the causes of infeasibility and testing changes in personnel policy to help achieve the goals.

Another important application of STRAP-O is that from which it derives its name. STRAP-O enables the Navy to adopt the "structured accession planning" concept. Rather than fixing end strength early in the programming process and then determining accession to fill the gap between inventories and allowable end strength, STRAP-O uses "structured spaces" as the goal and then determines manpower overhead and accessions needed to achieve these goals. End strength can then be computed as a function of alternative force levels desired in the future. Current methods permit future force levels to be affected by current end strength considerations.

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